

Culture of Medicinal Plants in the City of Fortaleza as a Proposal for the Sustainable Development of the Municipality

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Abstract

Medicinal plants cultivation has grown all over the world. This paper studies the role of Medicinal plants cultivation in sustainable development. The research takes the city of Fortaleza in Brazil as a case study. The results show that the proposed Living Pharmacy Program, which has been implanting for more than 20 years since 1990 in the municipality of Fortaleza, is enlarging the access of the population to the medicinal plants and physiotherapeutic medications, awakening their ecological conscience and thus contributing to economic and sustainable development of the municipality.

Keywords

Fortaleza, Living Pharmacy Program, Medicinal Plants, Sustainable Development

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1. Introduction

Using of the Fortaleza pants have been growing since the 1980s, due to many factors including the on going research, the growing of the consumers' acceptance and industrial interests in medicines that made from plants. Some research works have been carried out on the lower-income groups of Fortaleza and other cities of Brazil for medicinal plants in order to alleviate public concerns, owing to the elevated price of allopathic medicines. The main part of he research was done in Fortaleza, which considered the 5th largest city in Brazil and located in the northeastern Brazil with about 2.5 million inhabitants.

Previous research works include a study about the culture of cultivating medicinal plants in the city of Fortaleza to creating a model of environmental sustainability (Santos et al. 2005). This may be characterized in a generic form by the tripod of the variables of economic growth, social equity and

giving value to environmentally correct practices. (Donaire, 1995) Within these principles, the culture of medicinal plants should occur without the utilization of agro-chemicals (insecticides, herbicides and chemical fertilizers), irrigated with water free from chemical and bacteriological contamination: It should prioritize the conservation of the natural resources in the production areas, the utilization of organic solid wastes of urban origin (by means of the processes of composting and vermiculture) and the environmental education of the communities involved in the process.

2. Methodology

The methodology used in the research consists of the following steps and practices:

- Selection of urban areas and out-lying areas of the municipality of Fortaleza belonging to organs of the municipal government, which have been vacant; for

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example: gardens, patios, and the back yards of schools and health centers, free areas in plazas, central flower beds and lands adjacent to dunes and areas of transmission of electric energy.

- Preliminary analysis of the structure and fertility of the soil where the medicinal plants will be cultivated for the purposes of organic fertilization and the correction of the pH by means of liming. Annual monitoring of these soils by the means of the repetition of these analyses.
- Planning the construction of the medicinal plant beds, maintaining the native trees;
- Installation of a municipal garden or a source ("mother") garden duly organized for the production of green mass and the preparation of changes of selected medicinal plants, complemented with equipment for the drying, grinding and packaging of the dried plants, and of the installation of pharmaceutical workshops, that is, pharmotechnical laboratories, simply mounted, with the purpose of the preparation of phytotherapeutic products with the prime material produced in the same garden, suggestions established by Lorenzi and Matos (2002).
- Involvement of the municipal departments of health and the environment and of professionals of these departments, such as agronomic engineers, chemists and doctors who are respectively responsible for the techniques of the cultivation of medicinal plants, their processing into phytotherapeutics and their prescription to patients. It is also recommended that these professionals be attentive to the validation by research of the active principles of new medicinal plants and the changes in the laws, which regulate the use of these plants.
- Use of irrigation water free from bacteriological contamination, monitored monthly through the collection and analysis of fecal coliforms;
- Use of irrigation methods which are simple to install, of easy handling, such as hoses, watering cans, micro-sprinkling or dripping, and that first consideration be given to the economizing of water and that the methods be appropriate to the management of soil, water and plants.
- Plantation of arboreal species with medicinal value, which also serve as shade for other species and further as windbreak in areas where this practice is necessary; examples of shade plants being used are the juazeiro (*Caesalpinia ferrea*), the *moringa* (*Moringa oleifera* Lam), the aroeira do sertão (*Myracrodruon urundeuva* Allemao) and the jambolão (*Eugenia jambolana*). An example of the windbreak plants is the banana tree (*Musa X paradisiacal* L.).
- The studied areas for the cultivation of medicinal plants have low pollution levels and plantation of trees of the leguminous family such as the jatobá (*Hymenaea animifera* Strokes, *Hymenaea candolleana* Kunth, *Hymenaea courbaril* var. *obtusifolia* Ducke) which fix the carbon in the living biomass in an efficient form vegetation and soil micro-organisms in external areas of the cultivation of the medicinal plants, such as sidewalks, flower beds in the center of avenues and plazas. Also the plantation of gramineous plants in these areas, which apart from capturing the carbon gas in an efficient form, by its biomass may have some utility of an exemplified form, the *Vetiver grass* (*vetiveria zizanoides*), from which may be extracted an aromatic oil for the production of essences and perfumes; the citronela de Java grass (*Cymbopogon winterianus*). This possesses more citronella, the active principle responsible for the potential plant repellent, especially against the mosquito *Aedes aegypti*, which is the transmitter of dengue, a frequent epidemic in Fortaleza and other Brazilian cities.
- Utilization of solid wastes from the city, especially left-over from the pruning of trees, for the production of organic compost and vermicomposting; Native worms, along with African worms and worms from California, are being used in vermicomposting productions.
- Use of litter fall, derived from the cuttings of the city and the municipal garden for the recuperation of degraded areas, areas which will in the future be incorporated for the production of medicinal plants;
- Use of green fertilizer with leguminous plants, which is the base for the biological fixation of nitrogen, and leads to improvement in the environmental quality with less entrance of nitrates to the surface and subterranean waters and the production of economic benefits with the reduction of expenses in the purchase of nitrogenated fertilizers on the part of the farmer. Examples of leguminous plants used as fertilizer in this program are: the pigeon pea (*Cajanus cajan*) and the black mucuna (*Mucuna aterrima*), which are efficient in the control of nematodes.
- Utilization of manual labor, from those unemployed within the communities, for the manual culture of the medicinal plants; the mobilization of these persons has been principally made through contact with associations of the people who live in neighborhoods and slums and with sectors attached to the Catholic Church, such as Caritas;
- Development of educational works, touching on environmental issues in the culture of medicinal plants and orienting the community towards the correct use of the medicinal plants;

- Monitoring of the sanitary hygiene of the laboratory installations and of the personnel involved in the manipulation of medicinal plants and phyto-therapeutics;
- Production of quality phyto-therapeutics with guaranteed efficacy, from the scientifically proven medicinal plants.

Table 1. Medicinal Plants Produced in the Living Pharmacy Program of the Municipal Government of Fortaleza.

Cultivated species	Name	Used part	Products
<i>Ageratum conyzoides</i> L.	Mentrasato	Leaves	Mentrasato capsules
<i>Justicia pectorales</i> var. <i>stenophylla</i> Loen.	Chambá	Aerial part	Chambá syrup
<i>Lippia Alba</i> (Mill.) N. Brow	Cidreira	Leaves	Erva-Cidreira capsules
<i>Lippia sidoides</i> Cham	Alecrim-pimenta	Leaves	Alecrim-Pimenta soap Tincture of Alecrim-Pimenta
<i>Mentha x villosa</i> Huds.	Hortelã-rasteira	Leaves	Hortelã-Rasteira capsules
<i>Mikania glomerata</i> Spreng.	Guaco	Leaves	Guaco syrup
<i>Passiflora edulis</i> Sims.	Maracujá	Leaves	Maracujá capsules
<i>Alpinia zerumbet</i> (Pers.) B.L. Burt & R.M. Sm	Colônia	Leaves	No phyto-therapeutic is produced
<i>Plectranthus barbatus</i> Andr.	Malva-santa	Leaves	Tincture of Malva-Santa
<i>Symphyum officinale</i> L.	Confrei	Leaves	Confrei ointment
<i>Amburana cearensis</i> (Allemão). C. Smith	Cumaru	Skin/peel	Cumaru syrup
<i>Myracrodruon urundeuva</i> Allemão.	Aroeira do Sertão	Skin/peel	Cream of Aroeira Elixir of Aroeira

Source: Prefeitura Municipal de Fortaleza (1998).

3. Medicinal Plants of the Living Pharmacy Program in Fortaleza

Table 1 presents a general description of the medicinal plants used and the phyto-therapeutic medicines produced in the Living Pharmacy Program of the Municipal Government of Fortaleza. The data included in the table was taken from the municipality of Fortaleza.

The cultivated species include:

a) *Aroeira* do Sertão (*Myracrodruon urundeuva* Allemão), tree of the Anacardiaceae family, from 5 a 10 meters in height, native from the north-east of Brazil to São Paulo and Mato Grosso do Sul (Lorenzi et al., 1992). It is one of the principal plants of traditional north-eastern medicine, known for its secular use as a seat bath after childbirth, in which the cooking of the peel is used. This same preparation is also indicated for the home treatment of skin problems and problems of the urinary apparatus and the respiratory tracts (Lorenzi and Matos, 2002). The use of aroeira is recommended in oral form as an anti-inflammatory and healing agent indicated in the treatment of wounds, infected or not, in the skin, in gastritis, gastric ulcer, cervicitis, vaginitis and hemorrhoids (Bandeira, 2002).

b) Alecrim Pimenta (*Lippia sidoides* Cham.), tree of the

Verbenaceae family, from 2-3 meters in height, typical of the vegetation of the semi-arid north-east. Very aromatic and spicy leaves. Small whitish flowers joined in short-axled ears in the axils of the leaves. It is commonly multiplied by staking, utilizing the thinnest branches. The excess of water should be avoided during the irrigation, since being a plant originally of the *caatinga* (dry brushwood region), it is sensitive to high humidity. The leaves together with the flowers of the alecrim pimenta constitute the medicinal parts of this plant (Matos, 2000). The phyto-chemical analysis of the leaves of the alecrim pimenta registers up to 4% of essential oil, which contains more than 60% of thymol or a mixture of thymol and carvacrol, which has a very strong anti-microbial activity against *Staphylococcus aureus*, which causes infections of the skin and the throat, *Streptococcus mutans*, responsible for tooth decay, *Corynebacterium xerosis* cause of bad smell in the armpits and the feet, *Candida albicans* or *Nonilia*, found in canker sores and vaginal flow, of agents which cause *mycoses* in the skin, *Trichophytum rubrum* and interdigital *Trichophytum*. (Matos, 2000; Lacoste et al., 1996; Lemos et al., 1992). Among its fixed chemical components identified in the alcoholic extract of leaves and the stalk are flavonoids and quinones which contribute to its anti-septic action. The alecrim pimenta also has molluscicide action against the *Biomphalaria glabra*, and larvicide against the aquatic stage of the *Aedes aegypti*, mosquito which transmits dengue. Its medicinal use may

- be made with the local application of the tea, or the tincture diluted with one or two parts of boiling water, in the form of a gargle or a mouthwash, in the infections of the throat and the mouth, or in vaginal cleansings, as deodorant and intimate anti-septic. Both preparations are very efficient in treating acne, eczema, dandruff and bad smell in the feet, armpits and groin (Matos, 2000).
- c) *Mentrasato* (*Ageratum conyzoides*), an annual herb of the Compositae family, erect, hairy, aromatic, with up to a meter in height. It is very common in the humid areas of the whole north-east of Brazil, especially in the highlands. Tropical cosmopolitan plant, invader of cultivations and uncultivated areas (Matos, 2000). Clinical trials proved the analgesic activity of mentrasato in the chronic pain of patients attacked by arthrosis, with effects after a few days of use accompanied by an anti-inflammatory. Its administration, analgesic and anti-inflammatory preparation, as an anti-rheumatic and for the relief of menstrual colics, may be made with the leaves or the whole aerial part of the plant. Externally, the alcoholic extract may be used to 20% or an ointment of local use, in compresses and massages, in the case of articular pains of rheumatic origin or consequent on traumas (Lorenzi and Matos, 2002).
- d) *Cidreira carmelitana* (*Lippia Alba* Mill.) is an undershrub of the Verbenaceae family, of variable morphology, reaching a height of one and a half meters, rarely two meters, native to almost all Brazilian territory (Lorenzi et al., 1992; Matos, 1996). The tea of its leaves has a calming action and smooth spasmolytic and mucolytic, that is, its use contributes to turning the bronchial secretions more fluid, facilitating expectoration. Apart from being tasty and aromatic, the tea prepared from the leaves is efficacious in the relief of small crises of intestinal and uterine cholics, as well as in the treatment of nervousness and restless states. (Matos, 1996).
- e) The *chambá* (*Justicia pectoralis* var. *stenophylla* Leon.) is a small herb of the Acanthaceae family, which always presents itself green, is perennial, sub-erect, with up to 40 centimeters of height. The whole plant gives off a strong smell of cumaru some time after being collected. The *chambá* is easily multiplied by stakes or small pieces of branches, already rooted. (Lorenzi, 2002). In the ethno-pharmacological literature, it has been reported as a medication against rheumatism, chronic headache, fever, abdominal cholics, pulmonary inflammations, and cough and also as an expectorant, sudorific and aphrodisiac (Sousa et al., 1991).
- f) The *malva santa* (*Plectranthus barbatus* Andrews) is a herbaceous or bushy plant of the Labiatae (Lamiaceae) family, aromatic, perennial, erect when young and decumbent after one or two years, with few branches, with up to a meter and a half in height. Its origin is Indian, having been brought to Brazil probably in the colonial period. Ethno-pharmacological information includes the use of the leaves of this plant in every state of Brazil as a famed medicine for the treatment of liver and digestive problems. It may, therefore, be utilized in the control of gastritis, in dyspepsia, heartburn, gastric distress, and hangover and as a bitter stimulant for the digestion and the appetite (Sousa et al., 1991).
- g) The *confrei* (*Symphytum officinale* L.) is a perennial herb of the Boraginaceae family, with a short stalk of about 90 centimeters of height, being provided with developed rhizomes and fasciculated roots. It is originally from Europe and Asia, being already acclimated in almost the whole world. It is cultivated on a large scale, as a forage rich in proteins and for the preparation of bird rations. Its leaves have been used since antiquity in the form of tea from its leaves, juices and salads, in the home treatment of gastro-intestinal diseases, dysenteries, inflammations, rheumatism, hemorrhoids, cough, bronchitis and menstrual irregularities (Sousa et al., 1991; Simões et al., 1998). The ground roots have a use as a homeostatic, a curative in open wounds, ecchymoses and especially for the treatment of bone fractures. The quantity of alkaloids contained in a cup of tea of the leaves of *confrei* varies from 8 to 26 mg, from the roots rather more, which may provoke serious intoxications whose results only will appear from 3 to 4 years after. Due to this activity, the oral use of *confrei* has been prohibited by health organs of the governments of almost all the western countries, although its use as a healing agent is permitted and encouraged. The healing treatment of wounds, including varicose ulcers and skin irritations, may be made by local application of compresses and washings with the water of the decoction of the leaves, clean and squeezed, may be used directly over the area to be treated in the form of a compress (Simões et al., 1998).
- h) *Colônia* (*Alpinia zerumbet* (Pers.) B.L. Burtt & R.M. Sm), is a plant of the Zingiberaceae family, a large aromatic herb, rhizomatous, with long, wide leaves with fine points, and bell-shaped flowers. It is of Asiatic origin, but has been cultivated in all the states of Brazil as a medicinal and ornamental plant. It is commonly multiplied by rhizomes. The tea prepared with the leaves, flowers or roots of *Colônia* have been used in the home treatment of hypertension, as a tranquilizer and a diuretic (Matos, 2000).
- i) *Hortelã rasteira* (*Mentha x villosa* Huds) is a perennial herb of the Labiatae (Lamiaceae) family, erect, with 30-40

centimeters of height, originally from Europe and today cultivated in various countries, including Brazil. It has great medical and social importance for its action against intestinal micro-parasites (Matos, 2000). The hortelã has been used since antiquity as a condiment for meats and doughs, as well as for medicinal ends. Its most famous use is in the treatment against amoeba, giardia and trichomonas resulting from the investigation of the home practice of the use of the powder of the leaves of hortelã to treat children attacked with bloody diarrhea in the surrounding areas of Recife (Lorenzi and Matos, 2002).

- j) Maracujá (*Passiflora edulis* Sims,) is a vigorous perennial creeping plant, of the Passifloraceae family, widely cultivated principally in the north-east and centre-east of Brazil for industrial ends. Its fruits are sold in natural form, in pulp, juices or nectar. The ethno-pharmacological literature registers the use of the leaves of diverse maracujás, in the form of tea, as a tranquilizer and smooth sleep inducer. The results of pre-clinical trials applied to the extracts of the leaves demonstrate the existence of properties compatible with the popular indication, but its validation as a medical sedative is still not permitted. In the meanwhile, the wide use of this plant in the traditional home medical practices of various peoples is sufficient motive for its choice as a theme for deeper scientific studies aiming at its validation as a phyto-therapeutic medicine (Lorenzi and Matos, 2002).
- k) Guaco (*Mikania glomerata* Spreng.), is a creeping sub-woody plant of the Compositae (Asteraceae) family, perennial and of great importance. It is native to the south of Brazil and is being cultivated in various states, including Ceará, where it does not flourish (Simões et al., 1998). In the south of Brazil, popular medicine utilizes it, attributing to it the following properties: tonic action, depurative, anti-febrile and pectoral, appetite stimulant and anti-flu (Leal et al., 2000). Ethno-pharmacological information cites the use of its decoction in a gargle and a mouthwash in cases of mouth and throat inflammation, in massages or in compresses on the parts affected by traumas, neuralgias, itches and rheumatic pains. Of these properties, only its action to do with the respiratory tracts, justified by its bronchodilator effect, and expectorant were confirmed in scientific studies (Matos, 2000).
- l) Cumaru (*Amburana cearensis* (Allemão) A.C. Smith), is a tree of up to twenty meters of height of the Leguminosae - Papilionoideae (Fabaceae) family, with a trunk covered with a thick bark which is emitted in fine thin blades. All the parts of the plant are aromatic. It occurs from the north-east of Brazil to São Paulo, in the most arid areas (Lorenzi, 1992). The barks and seeds are used in popular medicine as a home medication in the treatment of

bronchitis, asthma, colds and flu, in the form of a boiling tea (decoction) to treat rheumatic pains. The efficacy and the therapeutic safety of this plant already evidenced through chemical and pharmacological studies, permit it to be considered as a useful chemical phyto-therapeutic program in public health, free for use in home practices of anti-inflammatory, analgesic, anti-spasmodic and bronchodilator medication (Lorenzi and Matos, 2002).

4. Results

The program was implanted in the municipality and found a cultural identity within the local population. Nowadays more than ten medicinal species are cultivated and the domestication and the culture of others are under studying and consideration in an area of approximately one hectare in different locations in the city. Some pharmaceutical workshops responded with the production of thirteen phytotherapeutic products; among them are: capsules of citron herb, capsules of *hortelã-rasteira*, capsules of *maracujá*, capsules of *mentrasto*, cream of *aroeira*, ointment of *confrei*, liquid soap from *alecrim-pimenta*, tincture of *alecrim-pimenta*, tincture of *malva-santa*, *chambá* syrup and *guaco* syrup, all of which are scientifically proven and have a great acceptance on the part of the population.

Carrying out some courses, lectures, trainings, & internships and the production of textbooks, posters, folder, seriate album, video and a phytotherapeutic guide is developing a continuing education process.

The Living Pharmacy Program, which has been implanted for more than 20 years in the municipality of Fortaleza, is enlarging the access of the population to the medicinal plants and phytotherapeutic medications, awakening their ecological conscience and thus contributing to the sustainable and economic development.

5. Conclusions

The practices of agricultural production presented in this research give a great value to environmental issues as it has succeeded in maintaining fertile the areas of cultivation and allowing medicinal plants to be produced in a satisfactory form. Moreover, the agricultural occupation avoids the pollution of urban areas by solid wastes, maintains the native vegetation and gives an opportunity for the development of a process of environmental education among the people involved in the process. The results has showed that the green spaces help to maintain the biological diversity and rendering healthy ecosystems, by means of the guaranteed survival of fundamental elements of the fauna, such as birds, reptiles, insects, worms and other organisms, along with

humans themselves in the urban environment.

The maintenance of these practices in the locations where they are already implanted and their diffusion into new areas through the spreading of the Living Pharmacy Program is recommended.

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